DISTRIBUTION, ABUNDANCE AND HISTORY OF CARIBOU AND MUSKOXEN NORTH AND SOUTH OF THE BOOTHIA ISTHMUS, NWT MAY-JUNE 1985

ANNE GUNN

AND

JOE ASHEVAK

DEPARTMENT OF RENEWABLE RESOURCES

GOVERNMENT OF THE NORTHWEST TERRITORIES

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ABSTRACT

We conducted a systematic strip transect survey for caribou (*Rangifer tarandus*) over Boothia Peninsula and south of Spence Bay between Pelly Bay and Rae Strait, Northwest Territories. The estimate of 8,900 ± 1,400 (S.E.) was based on 1,353 caribou counted on transect between 31 May and 9 June, 1985. Boothia Peninsula had almost three times as many caribou as estimated in 1975. Caribou are reoccupying areas not used since possibly the 1940s. Caribou, most likely Peary caribou (*R. t. pearyi*), calved in the Wrottesley River valley and barren-ground caribou (*R. t. groenlandicus*) calved on the lowlands east of Arrowsmith Bay. Any evaluation of the effects of the harvesting of caribou in the survey area is confounded because we cannot relate the hunted to the surveyed populations until seasonal movements of the caribou are known.

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INTRODUCTION

The numbers of caribou (Rangifer tarandus spp.) wintering each year near Spence Bay (Figures 1 and 2) have been increasing since the mid-1970s (D. Tucktoo pers. comm.). The only estimates of population size were from surveys conducted in the mid-1970s when Thompson and Fischer (1980) estimated there to be 1,739 caribou on Boothia Peninsula in June 1975. Heard et al. (1986) surveyed south of Spence Bay in May 1983 and estimated that there were 2,900 ± 1,000 caribou in the area. In the mid-1970s the harvest was 300 to 400 (William 1976, cited in Fischer et al. 1977). In 1983, the annual harvest had increased to 1,400 (Jingfors 1986) and has now more-or-less stabilized at 900 (S.D. 218, range 552 - 1,102, 1983-87, Kitikmeot Harvest Study, unpubl. data).

The Spence Bay Hunters' & Trappers' Association was interested in a survey to find out about the increase in caribou numbers. Additionally, current information is needed to evaluate the effect of the harvest before we could evaluate requests for changes in the number of commercial caribou tags available.

In the 1970s, natural gas discoveries on the High Arctic Islands led to a proposal for a gas pipeline route that would have crossed the study area. The proposed pipeline (Polargas Project) spawned studies to describe the physiography, soils, vegetation and wildlife along the route of the pipelines in the mid-1970s. Russell et al. (1978) mapped the caribou habitat and

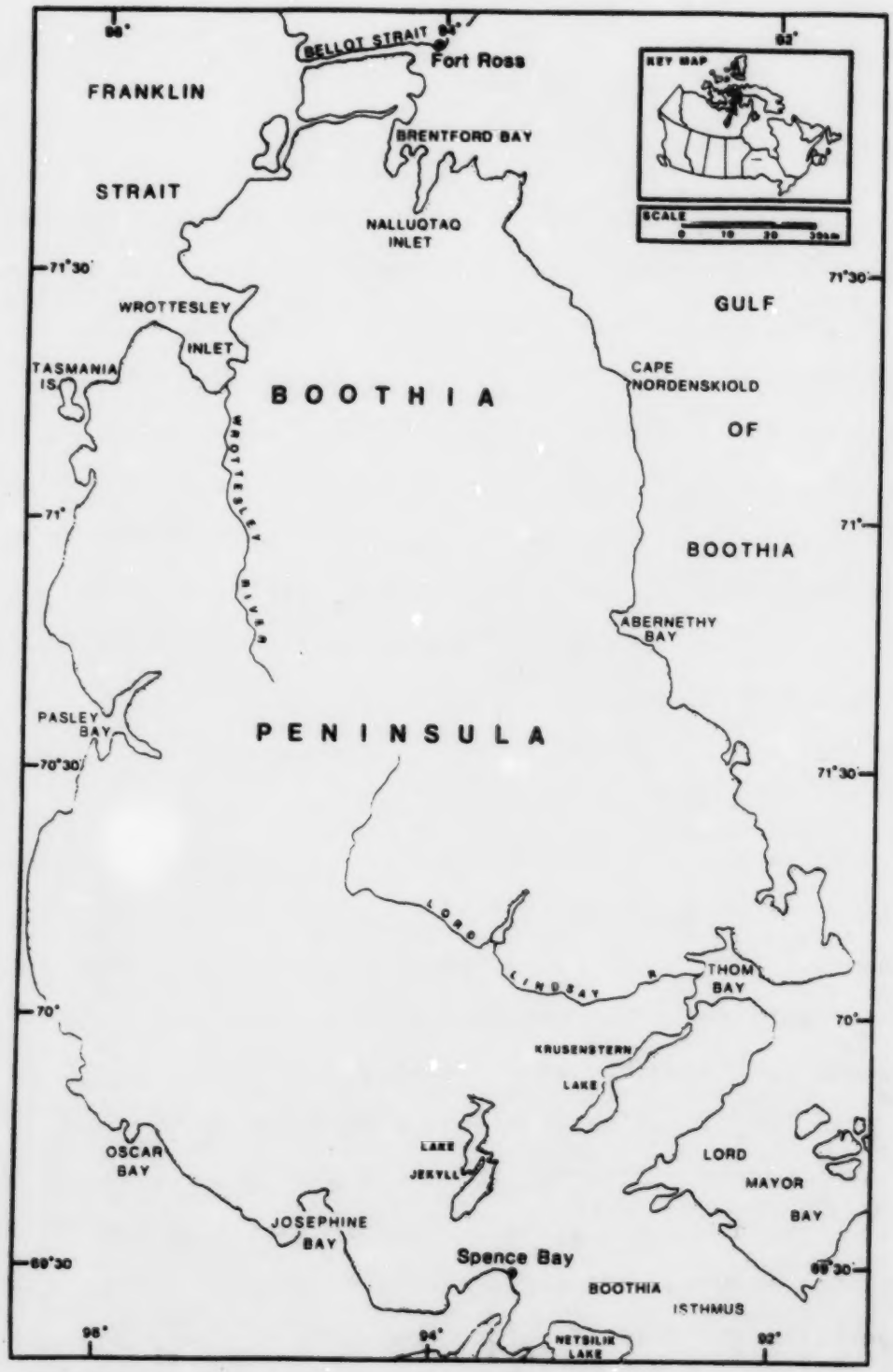

Figure 1. Boothia Peninsula, NWT.

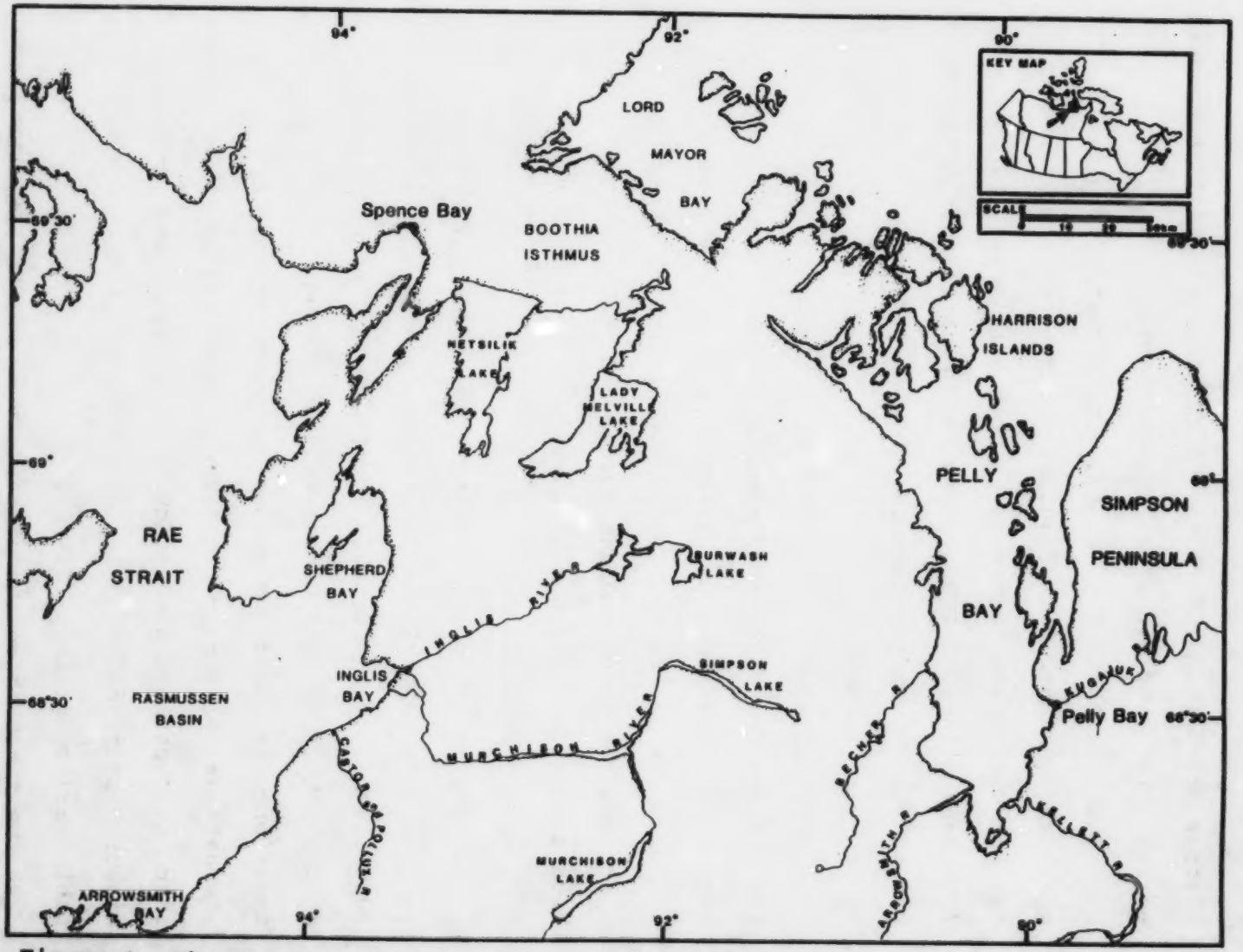

Figure 2. Simpson Lake area south of Boothia Isthmus, NWT.

Fischer and Duncan (1976) and Fischer et al. (1977) conducted aerial surveys to estimate caribou numbers.

Peary caribou (R.t. pearyi) and barren-ground caribou (R.t. groenlandicus) are both found on Boothia Peninsula as well as caribou with characteristics of both subspecies -"intergrades" (Thomas and Everson 1982). Hunters see both subspecies of caribou in the same groups (D. Tucktoo pers. comm.) in the vicinity of Spence Bay.

In this report, when we refer to Peary caribou we include the intergrades which they most phenotypically resemble. Peary caribou are difficult to distinguish from intergrades without measurements of the skulls. In April and May, Peary caribou move north and barren-ground caribou move south from the Isthmus and both subspecies return to the vicinity of Spence Bay in September (D. Tucktoo pers. comm.).

The first step in evaluating the effect of harvesting is to identify the populations so that their size may be estimated. Populations are customarily identified on the basis of their annual return to traditional calving grounds (Thomas 1969); therefore, we timed our survey to locate calving areas. The standard aerial survey technique used to monitor the numerical trend in a caribou population is to estimate the numbers of breeding cows when they are conveniently gathered together on their calving grounds (Heard 1985).

The first objective of our survey was to estimate the numbers of caribou on the Boothia Peninsula and the area south of

Spence Bay (the Simpson Lake area). The second objective was to determine which subspecific forms used which areas for calving (based on the caribou's appearance). To fulfill these two objectives, we conducted a systematic strip transect survey of Boothia Peninsula and the Simpson Lake area between 31 May and 9 June 1985.

STUDY AREA

The survey area (Figures 1 and 2) was the Boothia Peninsula and the land immediately to the south to 68°N, lying west of 90°W and east of 95°W (referred to as the Simpson Lake area). Aircraft range from Spence Bay dictated the southern boundary of the survey area. This southern boundary ran east from Arrowsmith Bay along 68°N to the Arrowsmith River.

Central Boothia Peninsula is dominated by rugged Precambrian Uplands flanked by Palaeozoic limestone lowlands to the northeast and southwest (Dunbar and Greenaway 1956). The hills and steep-sided valleys of the northern uplands are the most rugged and the highest toward the east coast. The central part of the uplands is a high rolling plateau. Outcrops of Precambrian rock separated by glacial drift dominate the landscape east of Netsilik Lake to the mouth of the Murchison River. To the southwest, the covering of glacial drift is thicker and the landscape is flatter and characterized by eskers.

METHODS

We did not precede the systematic aerial survey with an aerial reconnaissance survey so as to use the available flying time to cover the largest area possible. The stratification of survey area was based on densities of caribou seen during surveys conducted in the mid-1970s (Thompson and Fischer 1980). Coverage of 20% was achieved in Stratum I (Boothia Peninsula north of 70°18'N) by flying over transects spaced 8 km apart. On Stratum II (Boothia Peninsula 71°18'N south to Spence Bay) and Stratum III (Spence Bay south to 68°N) coverage was 10% and the transects were 16 km apart. We oriented the strip transects east-west across the shorter dimension of the survey area to reduce sampling error by increasing the number of transects (Norton-Griffiths 1978). The orientation of the transects perpendicular to the long axis of the coastline and the major rivers facilitated navigation and avoided sampling biases caused by concentrations of caribou along drainages. The first transect was randomly placed along a line of latitude and then the other lines were evenly spaced. Aircraft altitude was 150 m above ground level and airspeed was 160 km/h. The transect width was 0.8 km on either side of the aircraft.

The survey aircraft was a Helio-Courier on wheel skis. The survey crew comprised a right and left observer seated in the rear and the pilot who navigated and plotted observation numbers on 1:250,000 scale topographic maps. The left observer recorded

the sightings for both observers by location number in a field notebook.

The wire was stretched from an eye bolt on the wing to the fuselage (the Helio-Courier does not have wing struts). Boundaries for the inside and outside of the transect were calculated (Norton-Griffiths 1978) and marked by red tape on the wires and windows. We checked the markers by flying at 150 m above ground level over a truck parked 0.8 km from the runway end markers on the Cambridge Bay airstrip.

No sex and age classification counts were attempted, but we recorded the presence of hard antlers (cows) or antlers in velvet (bulls). The tone of the velvet (light or dark) and the pelage were recorded to distinguish Peary from Barren-ground caribou.

We used Jolly's (1969) Method 2 to calculate the population estimate from the numbers of caribou other than newborn calves counted on transect. We tested for differences between the counts of caribou on and off transect by the left and right observers with a Wilcoxon Matched Pairs Test.

RESULTS

Population Estimate

We counted 1,353 caribou on 4,806 km of strip transects flown across the survey area (Table 1, Appendix A). The estimate for the census zone was 8,900 +/- 1,400 (S.E.) caribou or (5,700 - 12,976 based on 95% confidence interval). The overall coefficient of variation was 15.7%. The two low-coverage strata (II and III) had high coefficients of variation (85.7% and 31.7%) compared to Stratum I (11.3%), which had received double the coverage.

The total flying time of 71.6 h included 18.7 h of ferry time to and from Norman Wells to Spence Bay and 22.8 h of ferry time between Spence Bay (our operational base) and the transects. We flew over the transects in Stratum I between 31 May and 3 June, those in Stratum II on 6 June and Stratum III between 7 and 9 June 1985. Weather conditions that would influence the conspicuousness of the caribou varied (Table 2) and were poor at higher elevations. Snow cover was judged to be 90-100% on areas higher than 300 m above sea level but 40-80% at lower elevations of Stratum I. On the lower elevations of Stratum II snow cover was reduced to residual snowbanks by 6 June. In Stratum III the extensive cottongrass (Eriophorum spp.) tussock meadows were snow free by 9 June. The patchy snow cover, especially on Stratum I, and dull light that prevailed over about half of the transects

reduced the conspicuousness of the caribou.

The left observer counted significantly more caribou on transect than the right observer in strata I and III ($P<0.05$). The right observer, however, counted significantly more caribou off transect than the left observer ($P<0.05$) in strata I and III which may be because the right observer was inexperienced at transect surveys. The estimates have not been adjusted for the observer bias.

Table 1. Analysis of data from the strip transect survey of caribou on Boothia Peninsula and the Simpson Lake area, NWT, May-June 1985.

		STRATUM			
		I	II	III	TOTAL
Maximum number of transects	(N)	98	109	118	
Number of transects surveyed	(n)	22	6	11	
Stratum area, km	(Z)	18,855	13,860	25,856	58,571
Transect area, km	(z)	3,751	1,377	2,561	7,689
Number of caribou counted	(y)	939	11	403	1,353
Caribou density, caribou/km	(R)	0.25	0.01	0.16	
Population estimate	(Y)	4,720	111	4,069	8,899
Population variance	Var(Y)	285,840	9,013	1,658,545	1,953,398
Standard error	SE(Y)	535	95	1,288	1,398
Coefficient of variation	(CV)	0.11	0.86	0.32	0.16

Table 2. Weather and light conditions during strip transect aerial survey of Boothia Peninsula and Simpson Lake area, NWT, May-June 1985.

DATE	TRANSECT	WEATHER AND LIGHT CONDITIONS
31 May	1 - 8	Broken cloud; bright patches; fog patches interrupted western segment transect 6, 7 and 8
1 June		Low cloud and fog
2 June	8 - 13	Broken cloud and bright patches; fog and snow squalls on land over 300 m asl
3 June	14 - 22 (West)	Broken cloud and bright patches; white out conditions in snow and fog on land over 300 m asl
4 June	14 - 21 (East)	Broken to overcast cloud with bright to dull light
5 June		Low cloud and snow
6 June	21 - 28	Overcast, poor light
7 June	29 - 33	Broken to overcast cloud with bright to dull light
8 June		Low cloud and snow
9 June	34 - 39	Broken cloud and bright light; fog patches and snow squalls on ground 300 m asl

Group sizes ranged from 1 to 18 and mean group size was similar among the three strata (Table 3). The proportion of single caribou (43.4%) was higher on Stratum I than Stratum III (35.3%). The larger groups were bulls and juveniles but classification of the caribou in the groups was not consistently done. The first newborn calves were seen on 3 June on the Boothia Peninsula and consisted of nine cow-calf pairs and two calves in larger groups among the 244 caribou counted on transect in Stratum I. Calving had probably only just begun while we were surveying. We saw no more calves until 9 June when we saw 33 calves among 254 caribou counted on Stratum III. Some of those calves had bent hocks and hunched backs suggesting that they were only a day or two old.

Table 3. Mean group size of caribou by stratum observed during a strip transect aerial survey of Boothia Peninsula and Simpson Lake area, NWT, May-June 1985.

Stratum	No. of groups	Group size Mean	+/-	S.E.	Range
I	593	2.35		2.18	1 - 18
II	6	2.17		0.90	1 - 4
III	211	2.77		2.08	1 - 12

Distribution

On Boothia Peninsula, almost all caribou were north of Thom Bay (Figure 3). Cows and yearlings were concentrated in the

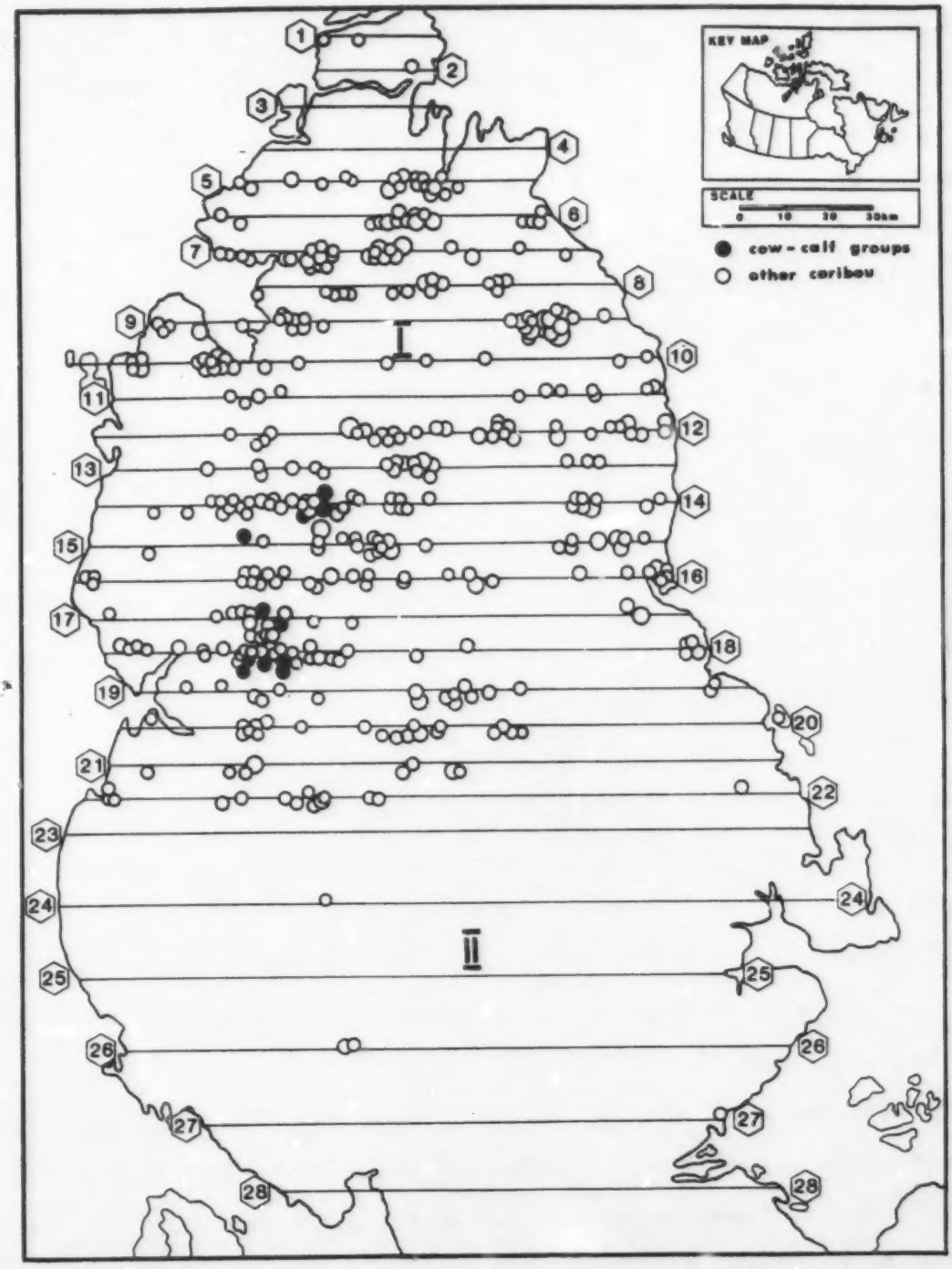

Figure 3. The locations of cow-calf groups and other caribou observed on transect during an aerial survey of Boothia Peninsula, NWT, May-June 1985.

wide valley running north from Pasley Bay to Wrottesley Inlet. The caribou concentrated in the northeast lowlands west of Cape Nordenskiold south to Abernethey Bay were mostly bulls and young animals. Groups of caribou were concentrated along the fiords and lakes connecting Wrottesley Inlet west to Brentford Bay. Caribou were scattered along the headwaters of Lord Lindsay River in the central uplands and many were moving north. South of Spence Bay, caribou were widely scattered in small groups (Figure 4). East of Simpson Lake caribou were concentrated along a tributary of the Becher River. The concentration of caribou south of Castor and Pollux River on the coastal cottongrass meadows of Arrowsmith Bay was mostly cows.

On Boothia Peninsula, snow cover was sufficiently extensive to reveal the directions and intensities of recent trails. Most trails were oriented north-south and were prevalent in the coastal lowlands along the east side of the central uplands. On the north coast at Brentford Bay and along Bellot Strait, trails lead onto the sea ice but were obscured by melt water. Those trails and the scarcity of caribou on the northern tip of Boothia Peninsula show that some caribou had moved to Somerset Island or Prince of Wales Island.

Caribou cows and calves were localized in two of the four areas of higher density (Figure 3). Most cows and calves were east and northeast of Pasley Bay and along the east side of the uplands bordering the Wrottesley River. The cows and calves were found more among the rock outcrops than on the valley floor.

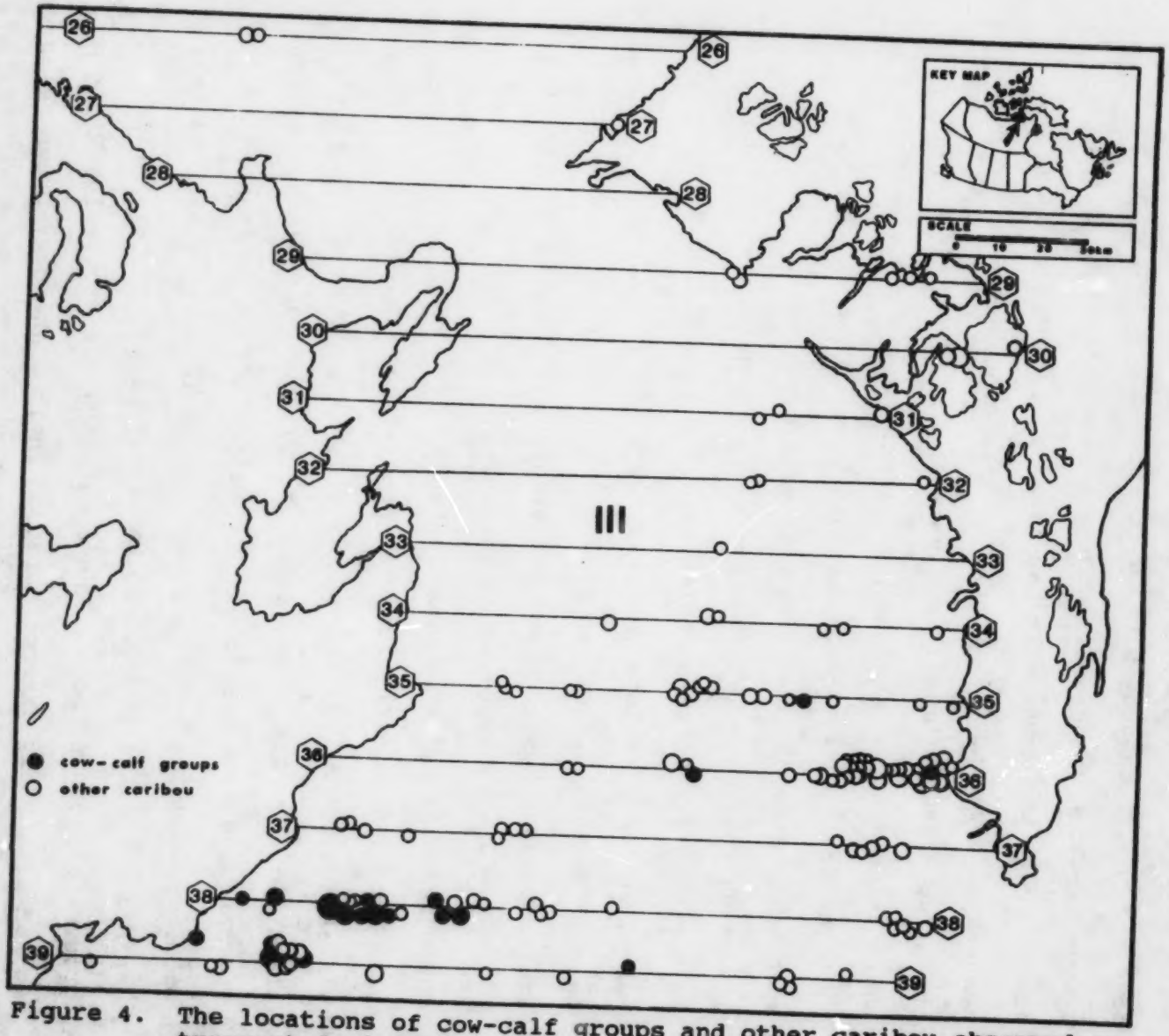

Figure 4. The locations of cow-calf groups and other caribou observed on transect during an aerial survey of the Simpson Lake area, NWT, May-June 1985.

South of the Boothia Isthmus in the Arrowsmith Bay area, however, cows and their newborn calves were splashing through the cottongrass tussock meadows. On a north-south ferry flight on 10 June through the Arrowsmith Bay area we did not find large numbers of cows and calves south of the concentration. Outside these two areas, cows with calves were only seen at Simpson Lake, where three small groups each had a calf.

The color of antler velvet can be characterized by subspecies: Peary caribou have lighter grey-brown and the barren-ground caribou have darker brown velvet. The juveniles and bulls on northeastern Boothia Peninsula all had conspicuously grey velvet on their antlers and grey-brown pelage. Only on the central Boothia did we see five caribou which had noticeably darker pelage though no new antler growth. The caribou south and east of Netsilik Lake had conspicuously darker pelage and the bulls had dark velvet covered antlers.

Thus, Boothia Isthmus was the dividing zone between Peary and barren-ground caribou in early summer, based on our aerial classification of whether bulls had light or dark antler velvet. The cows and juveniles could not be positively designated as either subspecies by aerial observation in early summer as the caribou are still in winter bleached pelages and new antler growth is inconspicuous. The cows along the Wrottesley River looked like Peary caribou based on their light grey-brown pelage.

DISCUSSION

Our estimate of 4,700 caribou on Boothia Peninsula supports the observation of hunters that caribou have recently increased in number. The increase is significant compared to the estimate of 1,739 caribou in June 1975 (Thompson and Fischer 1980). The areas surveyed south of Spence Bay in the mid-1970s and June 1985 are not exactly comparable but, nevertheless, the numbers of caribou using the area have increased. Fischer and Duncan (1976) only counted six caribou in June 1974 south of Spence Bay to the headwaters of the Murchison River where we estimated there to be 4,000 caribou. The following March, Fischer et al. (1977) counted 139 caribou between the Murchison and Hayes rivers. Those caribou had moved out of the area by 1-4 July 1975 when only 26 caribou were counted north of the Hayes River (Fischer et al. 1977). In May 1983, Heard et al. (1986) estimated there to be 2,900 +/- 1,000 (S.E.) caribou; however, their study area extended further south and east to include Simpson Peninsula and the Arrowsmith River.

Superficially, the 1982-87 reported annual harvest of 900 is too high a percentage of the herd (12-15%) to be sustained. Two factors, however, impede the use of the June 1985 estimate to evaluate the effect of the harvest. Firstly, the unknown accuracy of the population estimate itself. Timing the survey to coincide with calving probably leads to a large underestimate of population size. The patterned bare ground and melting snow

reduced the conspicuousness of the caribou and the overcast sky conditions would have compounded difficulties of seeing all caribou on transect.

The second consideration that precludes the evaluation of the harvest from the 1985 estimate is seasonal dispersal of the caribou and the arbitrary boundaries of the survey area reduce the likelihood that the hunted and surveyed populations are the same. In September and October, caribou start to converge on the Boothia Isthmus from the north and south for the winter and it is during the winter that most of the caribou are harvested. In April, some caribou return north and others migrate south (D. Tucktoo pers. comm.).

Our observations also show that some caribou moved north and left Boothia Peninsula. Miller et al. (1982) describe movements in May and June among Prince of Wales Island, Somerset Island and the Boothia Peninsula. There are, however, difficulties in relating the numbers of trails on the snow and ice to the number of individual caribou involved. Caribou may cross from the Boothia Peninsula to Somerset Island then to Prince of Wales Island (Miller et al. 1982). Also in some years caribou may travel from Prince of Wales Island to the Boothia Peninsula in the spring (Miller et al. 1982). Thus, accurate quantification of the number of individuals involved annually and their direction of travel is not feasible without expenditure of considerable effort. Miller et al.'s (1982) results and extrapolations from Thompson and Fischer's (1980) surveys suggest

that anywhere from 100 to 1000 caribou may be and likely have been involved in past seasonal movements between Prince of Wales Island and Somerset Island and the Boothia Peninsula in May and June.

Our observations support Fischer et al.'s (1977) description of the Wrottesley River valley as a calving area which extends northeast of Pasley Bay, an area identified by Spence Bay hunters as a calving area (D. Tucktoo pers. comm.) The calving that we observed at Arrowsmith Bay and Simpson Lake has not apparently been recorded before but further surveys are necessary to confirm and evaluate the importance of the areas as calving grounds.

Annual variations in the seasonal pattern of movements between the Boothia Peninsula, Prince of Wales Island and Somerset Island, and their dependence on snow and ice conditions are unknown. Repeated surveys or, more expediently, radio-telemetry will be required to ascertain whether the calving at Wrottesley Inlet is an annual occurrence or the result of early calving by cows of a population that migrates to Prince of Wales Island for calving. Likewise, further surveys will be necessary to confirm the discreteness of the population calving in the Arrowsmith Bay area and if it is indeed a separate population from the other mainland populations.

The subsequent movements of caribou travelling south after wintering on the Boothia Isthmus are essentially unknown. Fischer et al. (1977) described caribou that wintered between the Murchison and Hayes rivers as migrating elsewhere for the summer.

Possibly some of the caribou that wintered on the Boothia Isthmus migrated further south than 68°N and hence would not have been included in our June 1985 estimate.

Accounts of the distribution of caribou in the survey area up to the 1970s emphasize first the existence, then the disappearance by the 1930s of a migratory caribou population. Macpherson (n.d.) deduced from the journals of European explorers in the nineteenth century that caribou moved north to calve on the coastal high ground between Thom Bay and Lord Mayor Bay. After calving, the caribou summered around the large lakes on the Boothia Isthmus. When the caribou swam in the rivers while crossing through the Isthmus in spring, and especially autumn, the Netsilik and Arvilijjuarmiut hunted them from kayaks (Freeman 1976).

The introduction of firearms in the early 20th century freed hunters from the restrictions of slow, painstaking bow and arrow hunting in summer or reliance on ambushing caribou during river crossings. Hunters with firearms could hunt caribou year round, though most hunting took place in autumn, winter and spring. By the 1930s and 1940s, migration of caribou through the Boothia Isthmus dwindled, then stopped. Some caribou remained resident on the Boothia Peninsula where they were hunted in winter northeast from Spence Bay to Thom Bay and Nalluqtaq Inlet to Brentford Bay (Freeman 1976). South of Spence Bay, caribou were hunted south of Netsilik Bay almost to Hayes River especially around Inglis and Murchison rivers. Macpherson (n.d.) was told

in 1959 that caribou were scarce on Boothia Peninsula.

In the mid-1970s, caribou distribution was mapped during aerial surveys (Thompson and Fischer 1980) and from surveys of summer and winter caribou faecal pellets (Russell et al. 1978). The caribou distributions described from the two types of surveys generally coincided for the Boothia Peninsula. In the mid-1970s, caribou summered on the northwestern Boothia Peninsula, especially in the Wrottesley River valley and the central uplands. The wintering areas were the northeast uplands and coastal plain south to Thom Bay. Russell et al. (1978) sampled about 20 sites in the Boothia Isthmus for caribou faecal pellets but found none. The movement of caribou from north and south of the Isthmus to winter in the area south and west of Thom bay to Netsilik Lake in the 1980s is thus a relatively recent distributional change since the mid-1970s.

Macpherson (n.d.) cited Banfield's (1961) description of caribou using the area between Spence Bay, Thom Bay and southern Lord Mayor Bay as summer range. The winter range was the same area but extending some 50 km south. Between the 1950s and 1970s, the caribou's use of winter range contracted to the north. Thompson and Fischer (1980) noted the correspondence of the most intensively used resource area (Thom Bay to Spence Bay) and the absence of caribou. Those authors speculated that hunting pressure was preventing caribou from recolonizing southern Boothia Peninsula.

Fischer and Duncan (1976), Fischer et al. (1977) and Russell

et al. (1978) described the absence of caribou from the area south of Spence Bay to Arrowsmith Bay and east to the base of Pelly Bay. South of that area toward the Hayes River, caribou wintered in the central area and spread toward the Chantrey Inlet coast and Back River during the summer in the mid-1970s. Our results in June 1985 suggest that the summer and winter ranges are extending northward.

The intensity of resource use in the areas surrounding Spence Bay may have been reduced in the late-1970s when a trend toward an increased wage economy and centralization of activities in Spence Bay was strengthened. To relate, however, the reoccupation of the caribou winter range on the Boothia Isthmus to a reduction in hunting activities may be an over-simplification. Likewise, Machperson (n.d.) suggested that hunting pressure was not a satisfactory explanation of why the resident caribou on Boothia Peninsula did not increase after the loss of the migratory caribou segment which had been more vulnerable to hunting. Machperson (n.d.) speculated that scarcity of food on the winter range could be a limiting factor. Macpherson (n.d.) did not speculate whether it was an absolute shortage of forage or a relative shortage mediated through ice and snow conditions.

There has been a widespread reoccupation by caribou of, especially, winter ranges, in the Kitikmeot Region, which most likely reflects increased numbers of caribou in the 1980s. Hunters from Pelly Bay (C. Niptayok pers. comm.), Spence Bay (D.

Tucktoo pers. comm.), and Gjoa Haven (B. Konana pers. comm.) have reported more caribou and the return of caribou to areas not used since the 1930s-50s. Likewise on Victoria Island, hunters from Holman and Cambridge Bay report an increase in the numbers of caribou seen and a reoccupation of ranges (Gunn 1990).

The widespread changes in numbers of caribou raises questions about the taxonomy as well as the population identity of the hunted caribou on Boothia Peninsula. Conventionally, biologists have identified caribou populations on the basis of their affinity to calving areas (Thomas 1969). Our results suggest that Spence Bay people are hunting caribou from at least two subspecies which are distributed on at least two different calving areas but which overlap on the winter range. We found no evidence that caribou were calving on the high coastal ground between Thom Bay and Lord Mayor Bay as Macpherson (n.d.) suggested from the journals of European explorers.

Thomas and Everson (1982:2543) concluded from the measurements of 10 caribou aged 3 years or older collected on northern and central Boothia Peninsula that Peary caribou intergrades occurred on northern Boothia Peninsula and the caribou from central Boothia Peninsula were resident and predominantly R.t. groenlandicus. Our observation of Peary caribou (and possibly intergrades) calving on northern Boothia Peninsula suggests that Peary caribou are at least seasonally resident on the Peninsula.

The small group sizes seen during our June 1985 survey were

similar to those recorded for Peary caribou, which typically occur in small groups. Fischer and Duncan (1976) report mean group sizes of 2.7 and 3.1 on Prince of Wales Island and Boothia Peninsula, respectively, between 1 and 27 June, 1975. Fischer and Duncan (1976) did not have comparable data for south of Spence Bay for June, but they did report that groups observed between Spence Bay and south to Baker Lake were significantly larger than groups on Boothia Peninsula for 1 March to 30 April, 1975. Our observations of the barren-ground caribou south of Spence Bay being in small groups may be the dispersion due to calving and snowmelt.

The examination of serum proteins (Roed 1985) and non-metric skeletal characters as well as linear skeletal measurements would increase our discriminatory capability to identify the taxa and populations being hunted. The separation and identity of the hunted populations is a prerequisite step toward a more precise survey designed to estimate and monitor population sizes.

Caribou on the arctic islands have responded to variation in winter severity by changes in productivity as well as survival (e.g., Thomas 1982). Monitoring physical and reproductive condition of cows in relation to severity of winter weather would increase our capability to interpret changes in population size. Such an approach could assist in unravelling the complexities of factors regulating caribou populations and in examining the effect of hunting within the context of other ecological factors.

Our failure to see muskoxen highlights the virtual absence

of them in the area south of the Boothia Isthmus, although it used to be an important muskox area. Rae (in Boas 1964) noted the importance of muskoxen to the Arvilijjuarmiut people in the 1860s (who eventually formed the settlement of Pelly Bay). Ross (in Boas 1964) described the Netchillirmiut, who lived in the vicinity of the Boothia Isthmus, hunting muskoxen in the granite hills of northern Boothia.

Klutschak (1987) travelled overland with Inuit from the Hudson Bay coast north of Chesterfield Inlet to the Hayes River in April 1879. His party expected to find many muskoxen in the vicinity of the headwaters of the Hayes River but they found only one herd. The Utkuhikhalingmiut families that Klutschak's party met on the lower reaches of the Back River were using muskox hides as sleeping skins and clothing and fed muskox meat to the travellers.

The accounts of hunting and trapping before 1935 relate that the major muskox hunting areas were still the areas southwest and southeast of the head of Pelly Bay and toward Repulse Bay (Freeman 1976). Muskoxen numbers then dwindled and by the 1960s muskoxen were no longer hunted by the people of Spence Bay and Pelly Bay on the mainland. The muskoxen were assumed to have moved toward the upper Hayes River valley (Freeman 1976), but there are no sightings except for one or two in the lower Hayes River in the 1980s (B. Konana pers. comm.). Fischer and Duncan (1976) and Fischer et al. (1977) did not observe muskoxen during their surveys of the area between Spence Bay and Baker Lake in

1975 and 1976. An aerial survey of the major river valleys south of Spence Bay in November 1981 failed to find any muskoxen (A. Helmer pers. comm.). Heard et al. (1987) did not observe muskoxen east of Chantrey Inlet in May 1983 although they surveyed north from Chesterfield Inlet covering all the northeastern Keewatin to the Boothia Isthmus and the Melville Peninsula.

Explanations of the virtual disappearance of muskoxen from Chantrey Inlet north to the Boothia Isthmus and east to the coast of Hudson Bay are speculative. Possibly, muskoxen declined from increased hunting following the cultural changes of the late 1800s and early 1900s. Muskox hides were traded at Repulse Bay and Chesterfield Inlet and the wintering whalers also purchased muskox meat (Ross 1975). Besides the greater ease of hunting with rifles, the greater emphasis on fox trapping increased winter travelling and hunting to support the larger dog teams. Up until 1949, when a trading post was started at Spence Bay, people travelled between Repulse Bay, Gjoa Haven, Pelly Bay and Spence Bay and their routes were frequently the same river valleys favoured by the muskoxen. The surviving muskoxen were vulnerable as their preferred habitat in river valleys exposed them to continued hunting pressure.

The severity of winter weather may have compounded the effects of hunting, especially as the snow depths increase east toward Pelly Bay (Maxwell 1981). Once a population is reduced, other factors such as severe winters or predation can have a

disproportionately greater effect. The return of the muskoxen to the area has been surprisingly slow considering the large population west of Chantrey Inlet. There are only sporadic sightings of muskoxen east of Chantrey Inlet and the Back River and north of Spence Bay.

RECOMMENDATIONS

1. The taxonomic identity of the caribou hunted from Spence Bay should be described from samples of blood proteins and skeletal material.

2. The physical and reproductive condition of cows should be monitored in conjunction with collecting samples for sup-specific identity.

3. A stratified systematic survey should be flown to determine calving areas and to estimate the size of the calving populations.

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PERSONAL COMMUNICATION

Helmer, A. Renewable Resource Officer, Department of Renewable Resources, Government of the Northwest Territories, Pine Point, NWT

Konana, B. President, Hunters' & Trappers' Association, Gjoa Haven, NWT

Niptayok, C. President, Hunters' & Trappers' Association, Pelly Bay, NWT

Tucktoo, D. President, Hunters' & Trappers' Association, Spence Bay, NWT

REFERENCES

Banfield, A.W.F. 1961. A revision of the reindeer and caribou, genus Rangifer. National Museum of Canada Bulletin No. 177. (Biological Series No. 66). 137 pp.

Boas, F. 1964. The central eskimo. Univ. Nebraska Press, Lincoln, Nebraska. 261 pp.

Dunbar, M. and K.R. Greenaway. 1956. Arctic Canada from the air. Canada Defense Research Board, Ottawa, Ontario. 541 pp.

Fischer, C.A. and E.A. Duncan. 1976. Ecological studies of caribou and muskoxen in the Arctic Archipelago and northern Keewatin, 1975. Report prepared for Polargas Environmental Program by Renewable Resources Consulting Services Ltd. 194 pp.

Fischer, C.A., D.C. Thompson, R.L. Wooley, and P.S. Thompson. 1977. Ecological studies of caribou on the Boothia Peninsula and in the district of Keewatin, NWT, 1976. Report prepared for Polargas Environmental Program by Renewable Resources Consulting Services Ltd. 239 pp.

Freeman, M.M.R. 1976. Inuit land use and occupancy project. Indian and Northern Affairs Canada, Ottawa, Ontario. Vol. I, 262 p.

Gunn, A. 1990. The decline and recovery of numbers of caribou and muskoxen on Victoria Island. Pages 590-697 In: Canada's missing dimension: science and history in the Canadian arctic islands. Ed. C.R. Harington. Nat. Mus. Can., Ottawa, Ontario. 855 p.

Heard, D.C. 1985. Caribou census methods used in the Northwest Territories. Pages 229-238 In: T.G. Meredith and A.M. Martell (eds.). Proceedings of the Second North American Caribou Workshop. McGill Subarctic Research Paper No. 40. McGill University, Montreal. 327 pp.

Heard, D.C., T.M. Williams and K. Jingfors. 1986. Pre-calving distribution and abundance of barren-ground caribou on the northeastern mainland of the Northwest Territories. Arctic 39(1):24-28.

Heard, D.C., T.M. Williams and K. Jingfors. 1987. Pre-calving distribution and abundance of barren-ground caribou on the northeastern mainland of the Northwest Territories. NWT Renewable Resources File Report 71. 28 pp.

Jolly, G.M. 1969. Sampling method for aerial census of wildlife populations. E. Afr. Agric. For. J. 34:46-49

Jingfors, K. 1986. Inuit harvesting levels of caribou in the Kitikmeot Region, Northwest Territories, Canada 1982-1984. Rangifer Special Issue No. 1:167-172.

Klutschak, H. 1987. Overland to Starvation Cove. W. Barr, trans. and ed., Univ. Toronto Press, Toronto, Ontario. 261pp.

Macpherson, A.H. n.d. The caribou of Boothia Peninsula. Unpublished report, Canadian Wildlife Service, Ottawa, Ontario. 16 pp.

Maxwell, J.B. 1981. Climatic regions of the Canadian Arctic Islands. Arctic 34:225-240.

Miller, F.L., E.J. Edmonds and A. Gunn. 1982. Foraging behaviour of Peary caribou in response to springtime snow and ice conditions. Canadian Wildlife Service, Occas. Pap. No. 48. 41pp.

Norton-Griffiths, M. 1978. Counting animals. Afr. Wildlife Leadership Foundation, Keyna. 139 pp.

Roed, K. 1985. Genetic variability in Norwegian semi-domestic reindeer (Rangifer tarandus L.). Hereditas 192:177-184

Ross, G.W. 1975. Whaling and eskimos: Hudson Bay 1860-1915. National Museums of Canada, Public in Ethnology 10. 164 pp.

Russell, R.H., E.J. Edmonds and J. Roland. 1978. Caribou and muskoxen habitat studies. Environmental Social Program, Northern Pipelines, ESCOM Report No. A1-26. 40 pp.

Thomas, D.C. 1969. Population estimates and distribution of barren-ground caribou in Mackenzie District, NWT, Saskatchewan and Alberta - March to May 1967. Canadian Wildlife Service Report Series No. 9. 44 pp.

Thomas, D.C. 1982. The relationship between fertility and fat reserves of Peary caribou. Can. J. Zool. 60(4):597-602.

Thomas, D.C. and P. Everson. 1982. Geographic variation in caribou on the Canadian arctic islands. Can. J. Zool. 60(10):2442-2454.

Thompson, D.C. and C.A. Fischer. 1980. Numbers and distribution of caribou on the Boothia Peninsula, Northwest Territories. Can. Field-Nat. 94(2):171-174

Appendix A. Caribou observed on transect during an aerial survey of Boothia Peninsula and Simpson Lake area, NWT, June 1985.

Transect no. Stratum I	Transect area (km)	Caribou observed on transect		
		left	right	Total
1	43	0	2	2
2	46	0	2	2
3	61	0	0	0
4	106	10	2	12
5	107	14	31	45
6	128	34	7	41
7	133	34	49	83
8	133	12	17	29
9	131	65	49	114
10	214	33	13	46
11	202	10	4	14
12	210	39	31	70
13	205	33	16	49
14	210	53	33	86
15	210	33	28	61
16	218	43	17	60
17	221	9	17	26
18	221	40	30	70
19	218	30	12	42
20	237	20	21	41
21	246	13	4	17
22	251	20	9	29
TOTAL	3751	545	394	939

Transect no. Stratum II	Transect area (km)	Caribou observed on transect left	right	Total
23	251	2	0	2
24	278	1	0	1
25	235	0	0	0
26	240	0	6	6
27	189	2	0	2
28	184	0	0	0
Total	1377	5	6	11
Stratum III				
29	248	7	4	11
30	208	0	12	12
31	171	5	8	13
32	226	2	0	2
33	261	2	0	2
34	205	8	7	15
35	200	26	18	44
36	226	67	42	109
37	253	25	16	41
38	261	44	53	97
39	302	49	8	57
Total	2561	235	168	403